

CLAIMS

We claim:

1. A dynamic polymer-based coating, comprising:
at least one patterned polymeric layer for attachment to a surface,
said polymeric layer including at least one electrically conducting polymer, wherein a
contact angle of said polymeric layer substantially increases or decreases upon at least
one of oxidation and reduction.
2. The coating of claim 1, wherein said polymeric layer substantially expands
or contracts in at least one direction upon at least one of said oxidation and reduction.
3. The coating of claim 1, wherein said pattern comprises a plurality of
microscale or nanoscale features.
4. The coating of claim 3, wherein said plurality of features provide a
roughness factor of at least 2.
5. The coating of claim 4, wherein said roughness factor is at least 8.
6. The coating of claim 4, wherein a spacing between adjacent ones of at
least a portion of said plurality of features is less than 2 μm .

7. The coating of claim 1, wherein said polymeric layer is a polymer composite, said composite including at least one non-electrically conducting polymer mixed with said electrically conducting polymer.

8. The coating of claim 7, wherein said non-electrically conducting polymer comprises at least one selected from the group consisting of elastomers, rubbers, polyurethanes, polyimides, polyamides and polysulfones.

9. The coating of claim 1, wherein said electrically conducting polymer comprises at least one selected from the group consisting of polypyrrole, poly(p-phenylene) and polythiophene, and derivatives thereof.

10. The coating of claim 1, further comprising an electrode layer disposed beneath said polymeric layer.

11. The coating of claim 10, wherein said electrode layer is patterned, said pattern comprising a plurality of microscale or nanoscale features.

12. The coating of claim 11, wherein said pattern is interdigitated.

13. The coating of claim 1, further comprising a capping layer disposed on said patterned polymeric layer.

14. The coating of claim 13, wherein said capping layer comprises a flexible polymer, said flexible polymer selected from the group consisting of silicones, polyurethanes, and polyimides.

15. The coating of claim 13, further comprising a solid polymer electrolyte disposed between said plurality of features of said patterned polymeric layer.

16. A non-toxic biofouling preventative system, comprising:
a polymer-based coating disposed on a subsurface of a boat or ship, said coating comprising a polymeric layer, said polymeric layer including at least one electrically conducting polymer, and
a power supply for supplying a dynamic electrical signal to said polymeric layer, wherein a contact angle of said polymeric layer substantially increases or decreases upon at least one of oxidation and reduction responsive to said dynamic signal.

17. The system of claim 16, wherein said polymeric layer substantially expands or contracts in at least one dimension upon at least one of said oxidation and reduction.

18. The system of claim 16, wherein said subsurface comprises a metal, wherein one terminal of said power supply is electrically connected to said subsurface.

19. The system of claim 16, wherein said polymeric layer is a patterned polymer layer.
20. The system of claim 19, where said patterned comprises a plurality of microscale or nanoscale features.
21. The system of claim 20, wherein said plurality of features provide a roughness factor of at least 2.
22. The system of claim 21, wherein said roughness factor is at least 8.
23. The system of claim 21, wherein a spacing between adjacent ones of said plurality of features is less than 2 μm .
24. The system of claim 16, wherein said polymeric layer includes at least one non-electrically conductive polymer mixed with said electrically conducting polymer.
25. The system of claim 19, wherein said patterned polymeric layer comprises a plurality of electrically isolated features, comprising a patterned electrode layer beneath said polymeric layer, wherein said electrode pattern is interdigitated.
26. An electrowetting-based fluid pump, comprising:
a fluid conduit for flowing an electrolyte comprising fluid, and

a plurality of electrodes and a polymeric layer disposed on said plurality of electrodes attached to an inner surface of said conduit, said polymeric layer including at least one electrically conducting polymer, and

a power supply for applying a dynamic signal between said plurality of electrodes and said fluid or another electrode disposed opposite said plurality of electrodes, wherein a contact angle of said polymeric layer substantially increases or decreases upon at least one of oxidation and reduction responsive to said dynamic signal to pump said fluid through said conduit.

27. The pump of claim 26, further comprising an integrated circuit substrate, wherein said pump is integrated with said substrate.